Functions, Objects, Events

Functions, Arrow Functions, Callbacks, Objects, Classes, Constructors, Methods, Events

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SoftUni AI https://ai.softuni.bg

Agenda

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1. **Functions** in JS
   - Functions, Parameters, Return Value, Defining and Invoking
   - Arrow Functions, Functions as Parameters, Callbacks
2. **Objects** in JS
   - Keeping Related Values Together
3. Intro to **Classes** in JS: Defining and Using Classes
   - Classes, Fields, Constructors, Methods
4. **Events** and **Event Handling**
   - Event Handling in HTML and JavaScript

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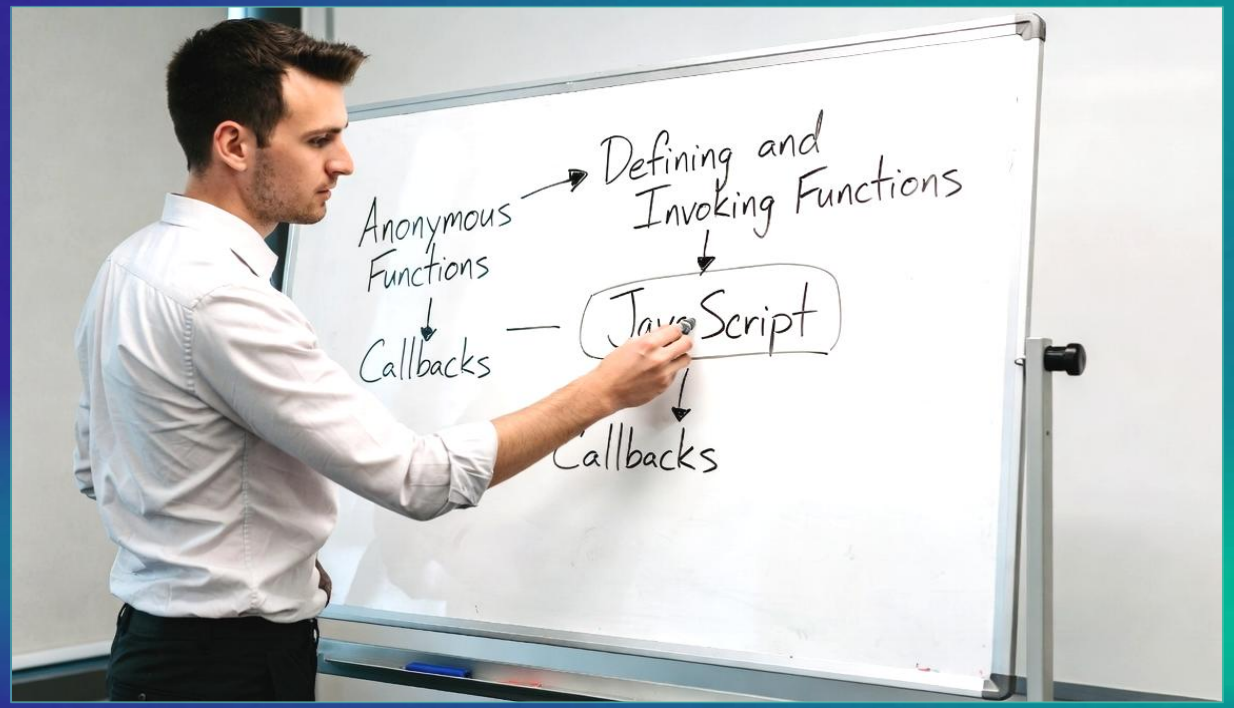
Breaks

20:00 / 21:00

Functions in JS

Defining and Invoking Functions, Recursive Functions, Debugging, Variable Arguments



Functions in JavaScript

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- In JavaScript, a **function** is **named block of code**

```
function printHello() {
  console.log("Hello!");
  console.log("I am a function.");
}
```

- Once defined, a function can be **invoked** multiple times

```
for (let i = 1; i < 10; i++) {
  printHello();
}
```

Functions in JavaScript

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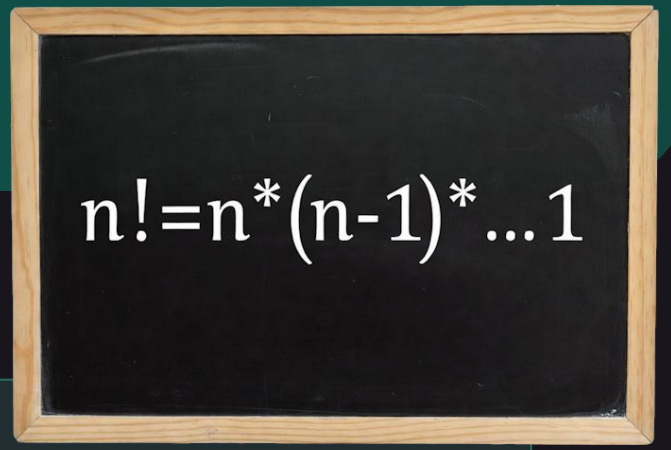
- Functions can take **parameters** and **return** values

```
function calcCircleArea(radius) {
  let area = Math.PI * radius * radius;
  return area;
}
```

- Once defined, a function can be **invoked** multiple times with different parameters

```
console.log(calcCircleArea(5));
console.log(calcCircleArea(12.5));
```

Recursive Functions



- A function can **invoke itself** recursively:

```
function factorial(n) {
  if (n == 0) return 1; // Base case
  return n * factorial(n-1); // Recursive call
}

console.log(factorial(5)); // 120
```

- **Recursion** is a powerful technique in programming
- Recursive functions should have a **base case** to avoid **infinite recursion**

Debugging & Breakpoints in VS Code

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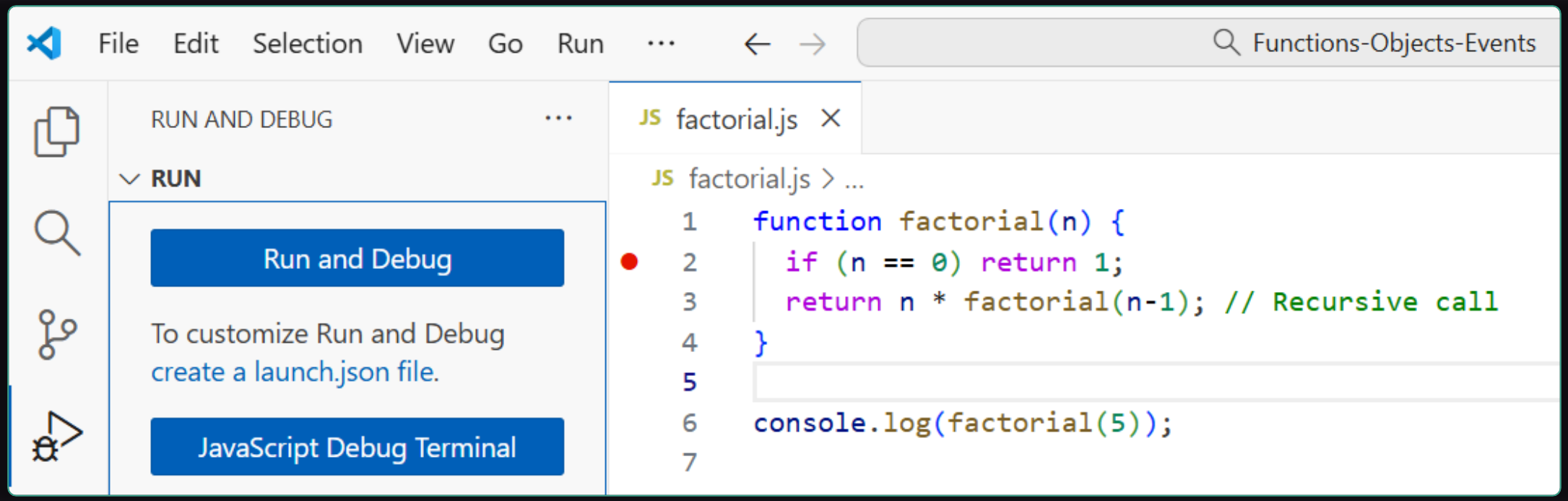
- **Debugging** == tracing the code execution to find bugs



- **Breakpoint** == intentional **pause-point** in the code
  - Stops the code execution to inspect the internal state

Using the VS Code Debugger

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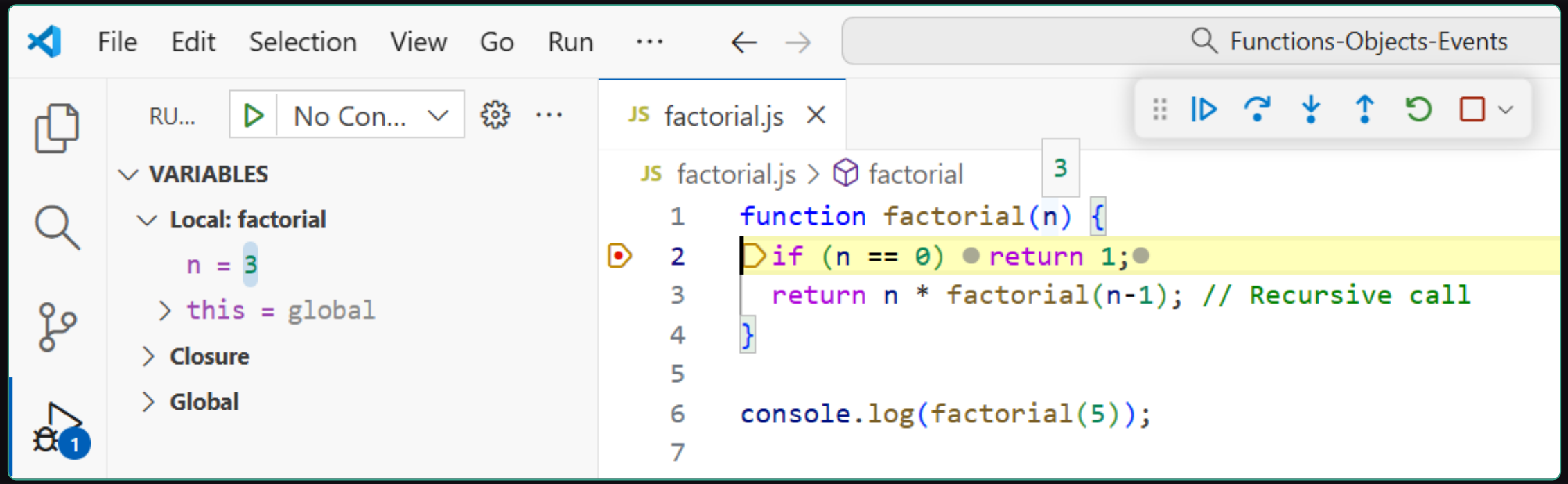
- Inspecting the internal **execution state**



- **Watch** / modify variables, view the **call stack**
- **[F5]** → Continue, **[F10]** → Step Over, **[F11]** → Step Into

Problem: Big Factorial

- Write a JS function for **calculate n!** (factorial)
  - Ensure it works for **big inputs** (e. g. 50 factorial)
- **Solution**: we shall use **BigInt** arithmetic

```
function factorial(n) {
  if (n == 0 || n == 1) return 1n;
  return BigInt(n) * factorial(n - 1);
}
console.log(String(factorial(50)));
// 30414093201713378043612608166064768844377641568960512000000000000
```

n!

Judge link: https://alpha.judge.softuni.org/contests/functions-objects-events/5273

Variable Number of Arguments

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```
function sum(...numbers) {
  let total = 0;
  for (let num of numbers)
    total += num;
  return total;
}

console.log(sum(2, 3)); // 5
console.log(sum(2, 3, 4, 5)); // 14
console.log(sum(3)); // 3
console.log(sum()); // 0
```

Variable number of arguments

for-of loop enumerates the input arguments

Problem: Incomes and Expenses

- We are given a sequence of **commands**:
  - **Income: {sum}**
  - **Spend: {sum}**
- Write a function to **process all commands** and calculate the final balance (starting with 0 initially)

```
console.log(processExpenses(
  "Income: 50", "Income: 70", "Expense: 30",
  "Income: 100", "Expense: 40", "Income: 50");
// 200
```

Solution: Incomes and Expenses

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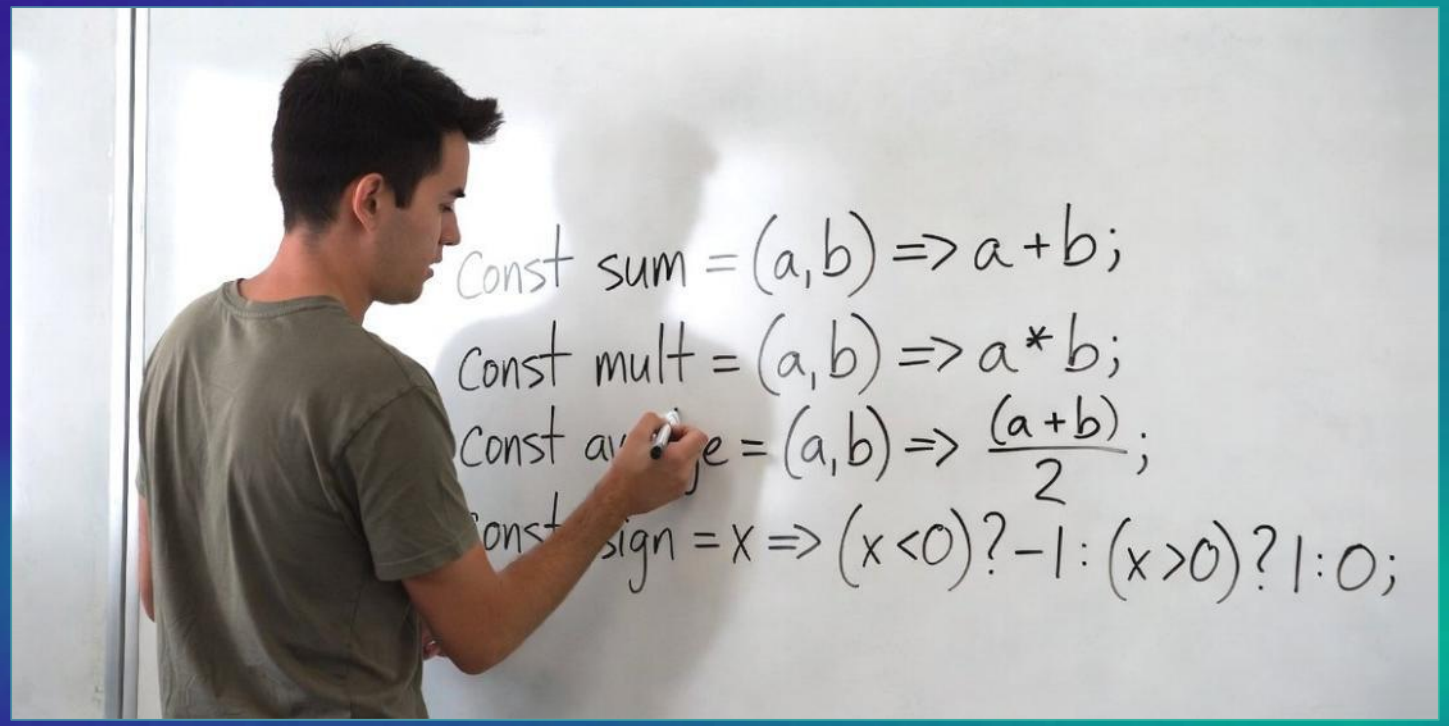
```
function processExpenses(...commands) {
  let balance = 0;
  for (let command of commands) {
    const [type, amount] = command.split(": ");
    const value = parseFloat(amount);
    if (type == "Income")
      balance += value;
    else if (type == "Expense")
      balance -= value;
  }
  return balance;
}
```

Judge link: https://alpha.judge.softuni.org/contests/functions-objects-events/5273

Arrow Functions

Function Expressions, Arrow Functions, Higher-Order Functions



Function Expressions

`f = function(…) {…}`

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- Variables can hold **values** of type "**function**"
- Defined through a **function expression**

```
const add = function(a, b) {
  return a + b;
}

console.log(add); // [Function: add]
console.log(add(2, 3)); // 5

let sum = add, sqrt = Math.sqrt;
console.log(sqrt(sum(8, 1))); // 3
```

Arrow Functions

```
(x) => 2 * x
```

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- **Arrow functions** (lambda) use the arrow operator `=>` to provide a **shorter syntax** for function expressions:

```
const sum = (a, b) => a + b;
const mult = (a, b) => a * b;
const average = (a, b) => (a + b) / 2;
const sign = x => (x < 0) ? -1 : (x > 0) ? 1 : 0;

console.log(sum(2, 5), mult(2, 5)); // 7 10
console.log(average(sum(2, 5), mult(2, 5))); // 8.5
console.log(sign(3), sign(0), sign(-4)); // 1 0 -1
```

Arrow Functions – More Examples

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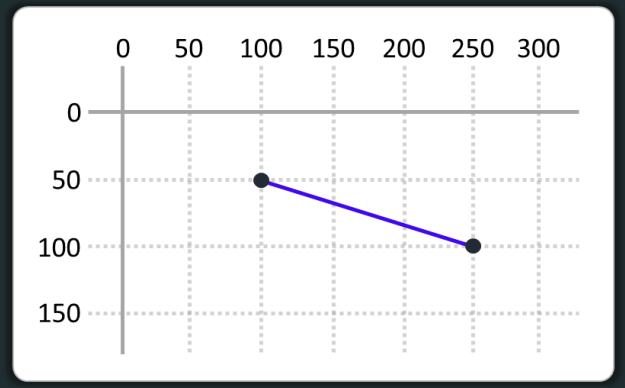
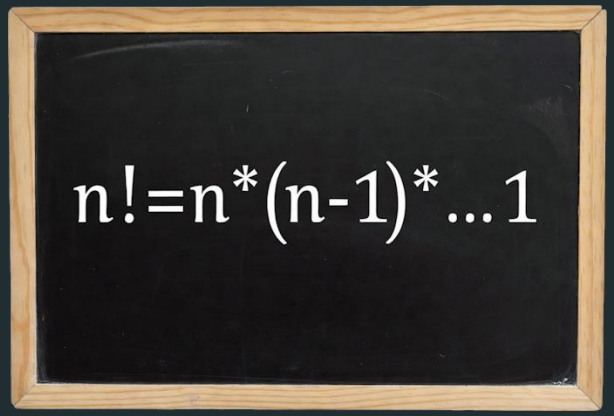
```
const distance = (x1, y1, x2, y2) =>
  Math.sqrt((x2-x1)**2 + (y2-y1)**2);

console.log(distance(100, 50, 250, 100);
// 158.11388300841898
```




```
const factorial = (n) => {
  if (n == 0) return 1;
  return n * factorial(n-1);
}

console.log(factorial(5)); // 120
```



Anonymous Functions

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- **Anonymous functions** have no name:

```
console.log(function(x) { return x * x });
// [Function (anonymous)] (unnamed function)
```

```
console.log(() => console.log("hello"));
// [Function (anonymous)] (unnamed function)
```

```
let sum = (a, b, c) => a + b + c;
console.log(sum);
// [Function: sum] (has name "sum", not anonymous)
```

Functions as Arguments

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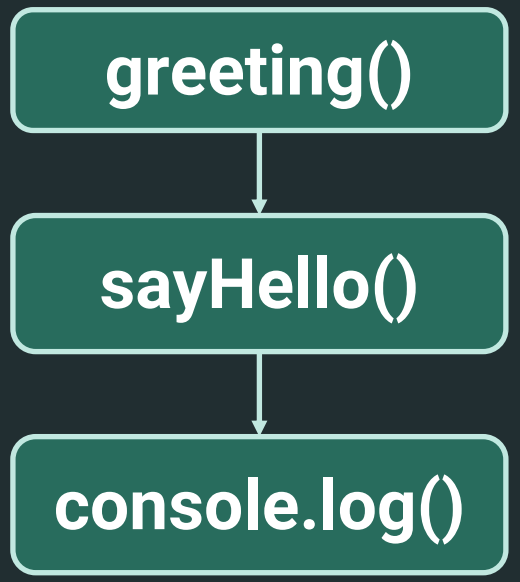
- **Functions** can be passed as **arguments** to other functions:

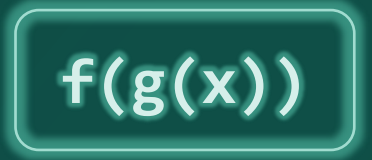
```
const sayHello = () => "Hello, ";
const sayHi = () => "Hi, ";
const sayBye = () => "Bye, ";

function greeting(greetingFunc, name) {
  return greetingFunc() + name;
}

console.log(greeting(sayHello, "JS!")); // Hello, JS!
console.log(greeting(sayHi, "JS!")); // Hi, JS!
console.log(greeting(sayBye, "JS!")); // Bye, JS!
```



Higher-Order Functions



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- **Higher-order functions** work by invoking other functions, passed as arguments (or return a function as a result)

```
function aggregate(start, end, operation) {
  for (var result = start, i = start+1; i <= end; i++)
    result = operation(result, i);
  return result;
}
```

```
console.log(aggregate(1, 5, (a, b) => a + b)); // 55
console.log(aggregate(1, 5, (a, b) => a * b)); // 120
console.log(aggregate(1, 5, (a, b) => '' + a + b)); // 12345
```

Problem: Special Numbers

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- Write a function to return all numbers in range [start … end]
  - Divisible to **3**
  - Containing digit **2**
- Use **higher-order function**: iterate over the range in a loop and filter the range with arrow function

```
console.log(specialNumbers(20, 30));
// Nums: 21 24 27
```

```
console.log(specialNumbers(100, 200));
// Nums: 102 120 123 126 129 132 162 192
```

Solution: Special Numbers

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```
function specialNumbers(start, end) {
  function generateRange(start, end, filter) {
    let result = '';
    for (let num = start; num <= end; num++)
      if (filter(num))
        result += (result ? ' ' : '') + num;
    return result;
  }
  let filterDiv3 = (num) => num % 3 == 0;
  let filterContains2 = (num) => num.toString().includes('2');
  let filters = (num) => filterDiv3(num) && filterContains2(num);
  return "Nums: " + generateRange(start, end, filters);
}
```

Judge link: https://alpha.judge.softuni.org/contests/functions-objects-events/5273

Function Returned by Function

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- A **function can return another function** as output:

```
function greeting(message) {
  return function(name) {
    return message + name;
  }
}

let sayHi = greeting("Hi, ");
console.log(sayHi); // [Function: anonymous]
console.log(sayHi("Steve")); // Hi, Steve

let sayWelcome = greeting("Welcome, ");
console.log(sayWelcome("Steve")); // Welcome, Steve
```

```
f(x) => function g(x)
```

Closures

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- **Closure** == function returning a function, with an **internal state**

```
function createCounter(start) {
  let count = start; // Internal state: count
  return function() {
    return count++;
  }
}
let counter1 = createCounter(100);
console.log(counter1(), counter1()); // 100 101
let counter2 = createCounter(1);
console.log(counter2(), counter2()); // 1 2
```

IIFE

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- **IIFE** == Immediately Invoked Function Expression

```
(function(x) {
  console.log(x * 2);
})(5); // 10
```

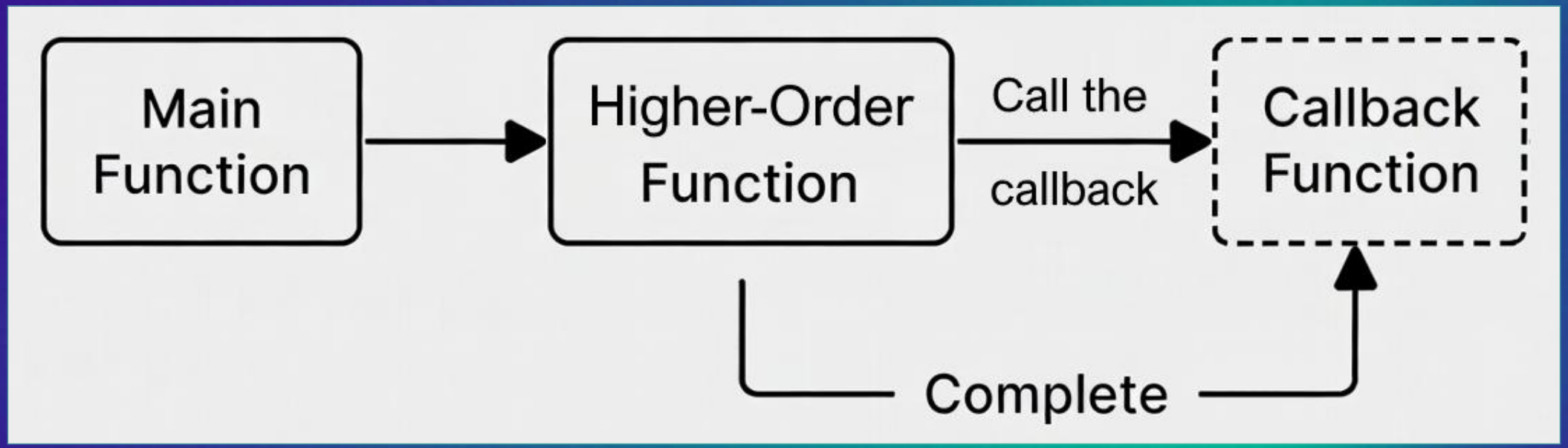
```
((x) => {
  console.log(x * 2);
})(5); // 10
```

- Why to use IFFE? → to **hold data private**

```
(() => {
  let privateData = 42;
  console.log("Inside:", privateData);
})();
console.log("Outside:", typeof privateData); // "undefined"
```

Callback Functions

Functions, Sent as Arguments,
Designed to be "Called Back"



Callbacks

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- In programming, a **callback function** is a function, given as parameter, indented to be "***called back***"

```
function scanRange(start, end,
    onStart, onNumber, onEnd) {
  onStart(); // Invoke a callback
  for (let i = start; i <= end; i++) {
    onNumber(i); // Invoke a callback
  }
  onEnd(); // Invoke a callback
}
```

Using Callback Functions

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- Invoking a function, which requires **callback functions**:

```
scanRange(1, 3,
  () => console.log("Starting scan..."),
  (num) => console.log("Found number: " + num),
  () => console.log("Scan complete.")
);
```

```
Starting scan...
Found number: 1
Found number: 2
Found number: 3
Scan complete.
```

Built-In Callbacks in JavaScript

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- In JavaScript **callbacks** are highly popular, for example:
  - **setTimeout(…)** will invoke a **callback** after time elapsed

```
console.log("Starting a timer…");

function timeoutCallback() {
  console.log("Time's up!");
}

setTimeout(timeoutCallback, 2000);

console.log("Waiting for 2 seconds …");
```

```
PROBLEMS  OUTPUT  DEBUG CONSOLE  ···
C:\nodejs\node.exe .\timer.js
Starting a timer…
Waiting for 2 seconds …
Time's up!
```

Real-World Callbacks in JS

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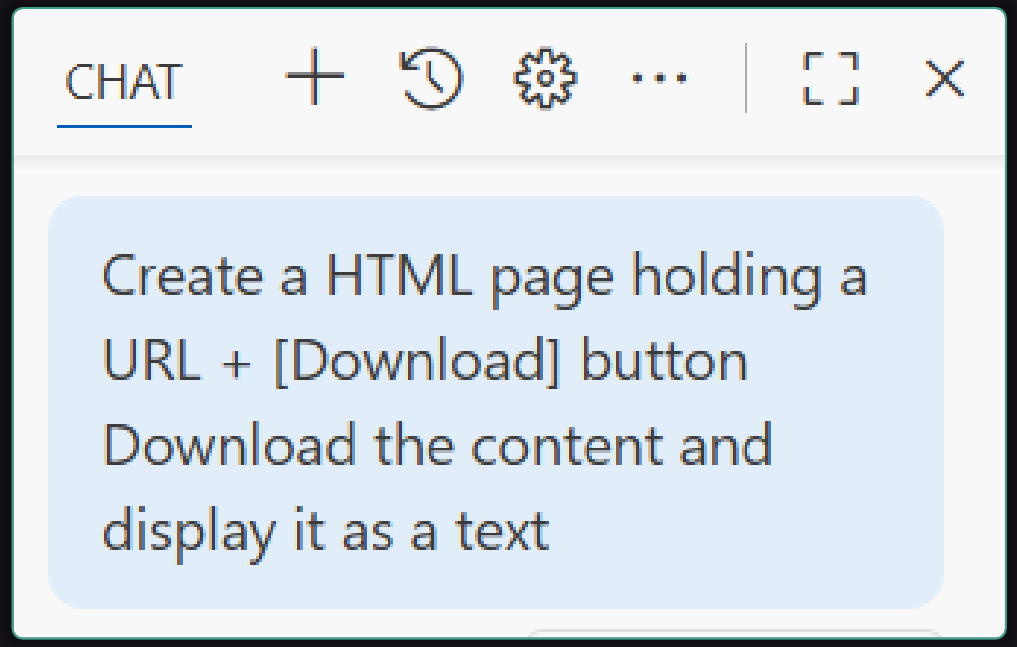
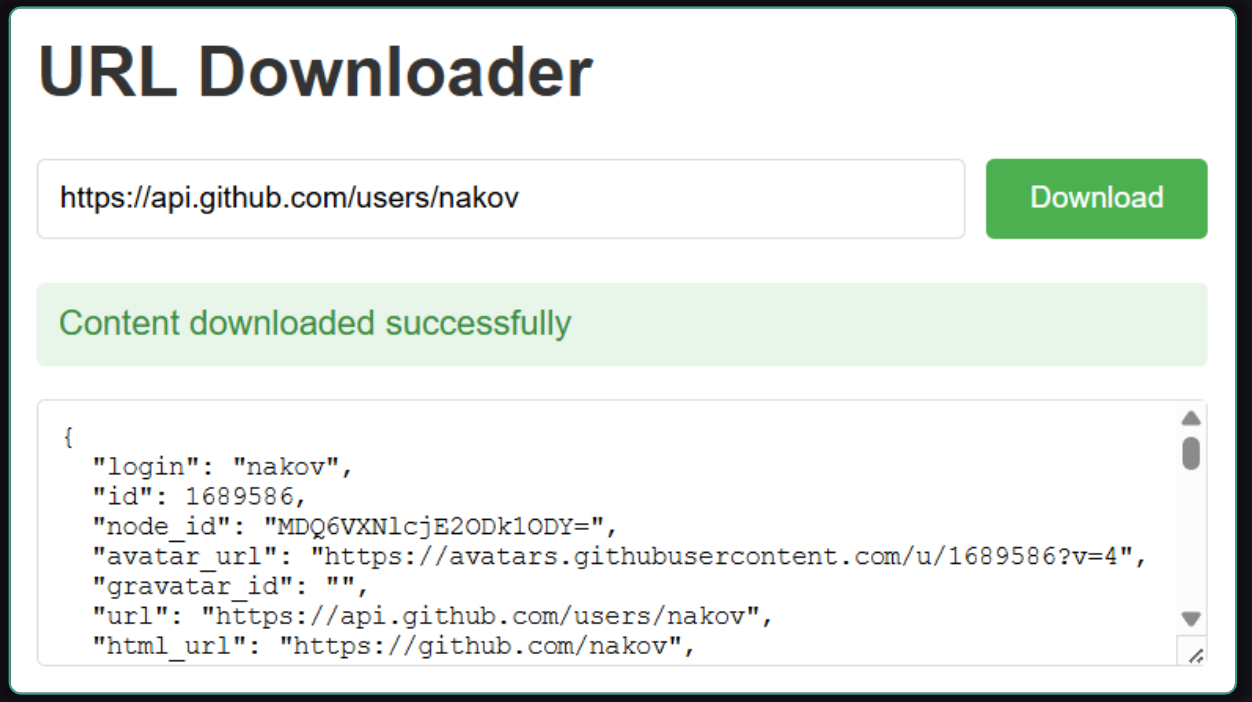
```
const https = require('https');
let request = https.get('https://softuni.org');
request.on('response', function(response) {
  let data = '';
  response.on('data', chunk => data += chunk);
  response.on('end', () => console.log(data));
});
request.on('error', function(error) {
  console.log('Network error: ' + error.message);
});
```

Problem: URL Downloader

- Create a **HTML page** holding a **URL** + **[Download]** button
  - Download the content and display it as a text
- **Solution**: prompt **Copilot**





URL Downloader Fails

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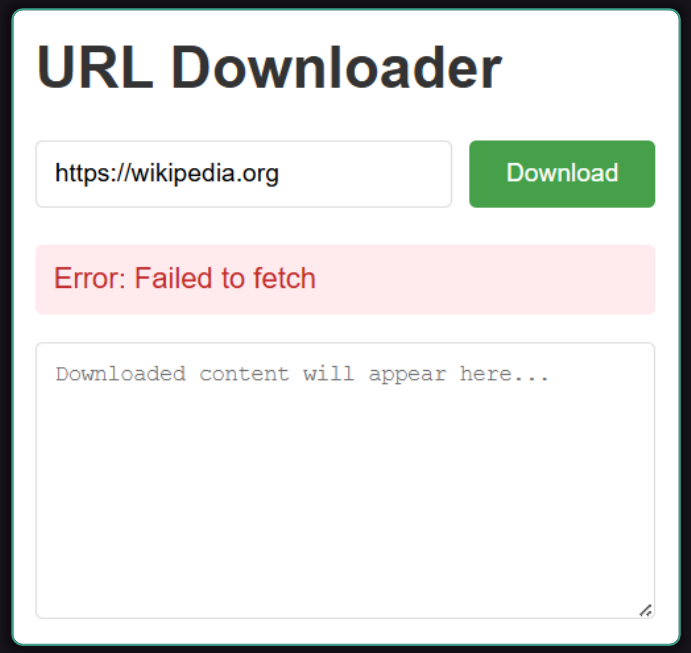
- The "**URL Downloader**" app **fails** to load most Web sites:
  - Loading `**https://wikipedia.org**` → Error: Failed to fetch
- This is a **security limitation** in Web browsers: **CORS policy**



- Use CORS-enabled URL addresses, e.g.
  - https://api.github.com/users/nakov
  - https://catfact.ninja/fact
  - https://api.chucknorris.io/jokes/random
  - https://pokeapi.co/api/v2/pokemon/pikachu

Objects in JavaScript

Keeping a Set of Properties Together

Objects in JavaScript

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- **Objects** in JavaScript keep a set of properties together

```
let person = {
   name: "Maria",
   age: 24,
   town: "Sofia"
};
```

person	
name	Maria
age	24
town	Sofia

```
person.age++;
console.log(`I am ${person.name}.`);
console.log(`I am ${person.age} years old.`);
```

Working with Objects

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```
let person = { name: "Maria", age: 24 };
person.isStudent = true; // Add a new property
console.log(person);
// { name: 'Maria', age: 24, isStudent: true }
person.age++; // Change a property
console.log(person['age']); // Access by index → 25
delete person.isStudent; // Remove a property
console.log(person); // { name: 'Maria', age: 25 }
for (let key in person) // Loop through the object
  console.log(key + ": " + person[key]);
```

Nested Objects

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Nested object: object inside another object

```
const user = {
  name: "George",
  address: { town: "Plovdiv", country: "BG" },
};
console.log(user);

user.username = "gogo98";
let job = { title: "Developer", company: "SoftUni" }
user.job = job;
user.job.title = "CTO";
console.log(user); // { name : ..., address: ..., username: ..., job: ... }
```

Objects as Function Parameters

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```
function printUser({name, address: {town, country}}) {
  console.log(`Name: ${name}`);
  console.log(`City: ${town}`);
  console.log(`Country: ${country}`);
}

const user = {
  name: "Nina",
  address: { town: "Plovdiv", country: "BG" }
};
printUser(user);
```

This syntax is called "object destructuring"

Problem: Calculate Stats

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- Write a function to take **several numbers** as input and return an **object**, holding **statistics** about the numbers:
  - **Minimal** number, **maximal** number, **average** of the numbers, **sum** of the numbers

Input:	`calcStats(5, 10, 15, 20, 25)`
Output:	`{ min: 5, max: 25, average: 15, sum: 75 }`

Input:	`calcStats(2.50, -7.25, 17500.00, 0.25, 400, -0.5)`
Output:	`{ min: -7.25, max: 17500, average: 2982.5, sum: 17895 }`

Solution: Calculate Stats

- Functions can **return objects** as output:

```
function calcStats(...numbers) {
  let [min, max, sum] =
    [Number.POSITIVE_INFINITY, Number.NEGATIVE_INFINITY, 0];
  for (num of numbers) {
    if (num < min) min = num;
    if (num > max) max = num;
    sum += num;
  }
  return { min, max, average: sum / numbers.length, sum };
}
```

Group declaration + assignment

Return an object

Judge link: https://alpha.judge.softuni.org/contests/functions-objects-events/5273

Problem: Largest Rectangle

- Write a function to take **several rectangles**, given as **objects {width, height}** and print the **largest** of them

```
printLargestRectangle(
 {width:30, height:20},
 {width:5, height:120},
 {width:15, height:40},
 {width:25, height:25},
 {width:35, height:15}
);
```

```
Largest rectangle: 25 x 25 -> area: 625
```

Solution: Largest Rectangle

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```
function printLargestRectangle(...rectangles) {
  let largestArea = 0, largestRect = null;
  for (let rect of rectangles) {
    const area = rect.width * rect.height;
    if (area > largestArea)
      [largestArea, largestRect] = [area, rect];
  }
  if (largestRect)
    console.log(`Largest rectangle: ${largestRect.width} x
${largestRect.height} -> area: ${largestArea}`);
}
```

Judge link: https://alpha.judge.softuni.org/contests/functions-objects-events/5273

Methods in Objects

Implementing Logic with the Object State

object	`const rectangle = {`
state	`x: 150, y: 40,` `width: 20, height: 15,`

methods	`move: function(dx, dy) { … },`
	`calcArea: function() { … },`
	`toString: function() { … }`
	`}`

Methods: Functions inside Objects

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```
const rectangle = {
  x: 150, y: 40,
  width: 20, height: 15,
  move: function(dx, dy) {
    this.x += dx;
    this.y += dy;
  },
  calcArea() { return this.width * this.height; },
  toString() { return `Rect(${this.x}, ${this.y})`; }
}
```

Method move(dx, dy)

`this` means the object itself

Method toString()

Calling Methods of an Object

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```
console.log("" + rectangle); // Invokes toString()
// Rect(150, 40)

rectangle.move(50, -10);
console.log(rectangle.toString()); // Rect(200, 30)

console.log("Area:", rectangle.calcArea()); // Area: 300

for (let i=10; i<=100; i+=10) {
  rectangle.move(i, 0);
  console.log("Rectangle moved to: " + rectangle);
}
```

JSON

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- **JSON** is a text-format for storing JavaScript objects

```
const user = {
  name: "George",
  address: { town: "Plovdiv", country: "BG" },
};

const userJSON = JSON.stringify(user);
console.log(userJSON); // typeof(userJSON) → 'string'

const colorJSON = '{"red":75,"green":89,"blue":43}';
let c = JSON.parse(colorJSON);
console.log(`RGB(${c.red}, ${c.green}, ${c.blue})`);
```

Problem: Moving Points

- Write a JS function, to take as input a **JSON point {x, y}** and several **JSON moves {dx, dy}** and applies the moves

```
movePoints(
   '{"x":50, "y":100}',
   '{"dx":20, "dy":30}',
   '{"dx":-10, "dy":20.5}'
)
```

Note: these arguments are JSON strings, not objects!

```
Initial point: (50, 100)
Moved point: (70, 130)
Moved point: (60, 150.5)
```

Solution: Moving Points

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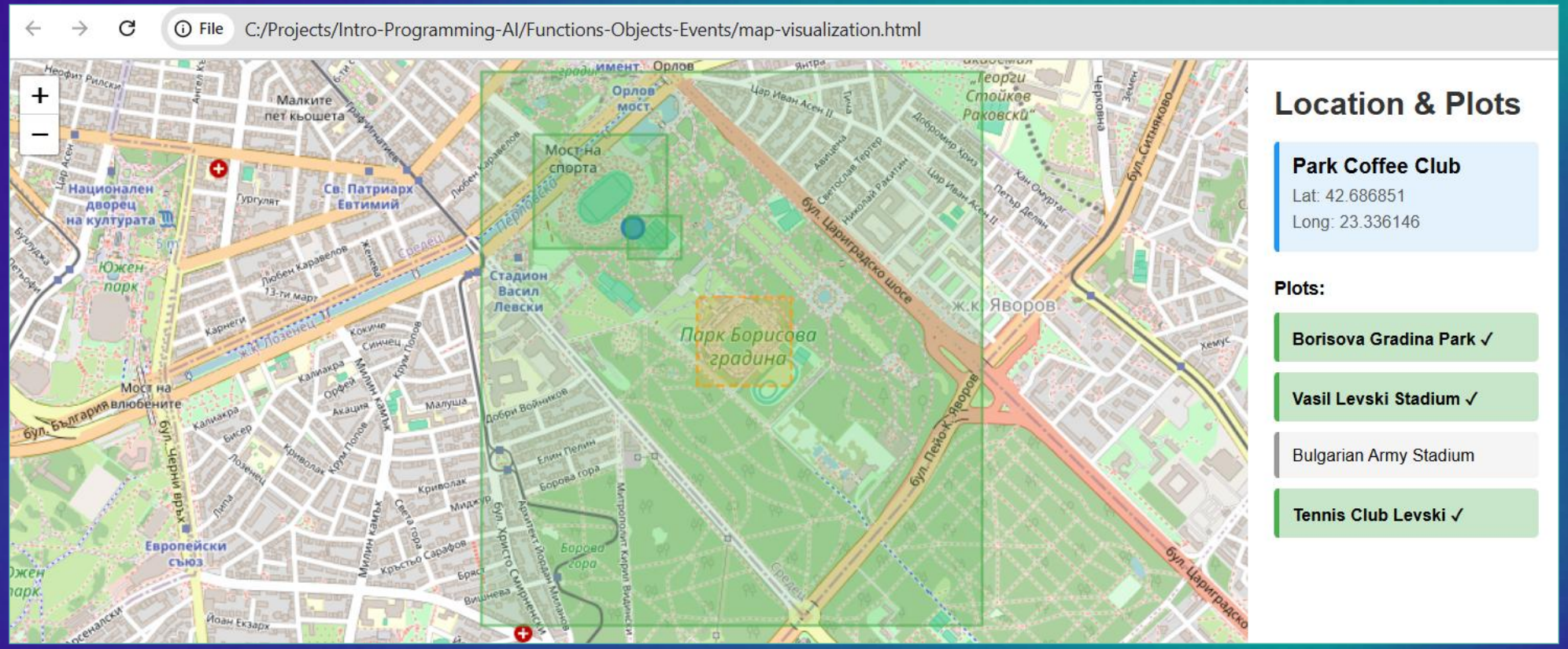
```
function movePoints(pointJSON, ...movesJSON) {
  let point = JSON.parse(pointJSON);
  console.log(`Initial point: (${point.x}, ${point.y})`);
  point.move = function(dx, dy) { this.x += dx; this.y += dy; };
  point.toString = function() { return `(${this.x}, ${this.y})`; };
  for (const moveJSON of movesJSON) {
    let move = JSON.parse(moveJSON);
    point.move(move.dx, move.dy);
    console.log("Moved point: " + point);
  }
}
```

Judge link: https://alpha.judge.softuni.org/contests/functions-objects-events/5273

Plots on an Interactive Map

Real-World Problem



Intro to Geographic Coordinates

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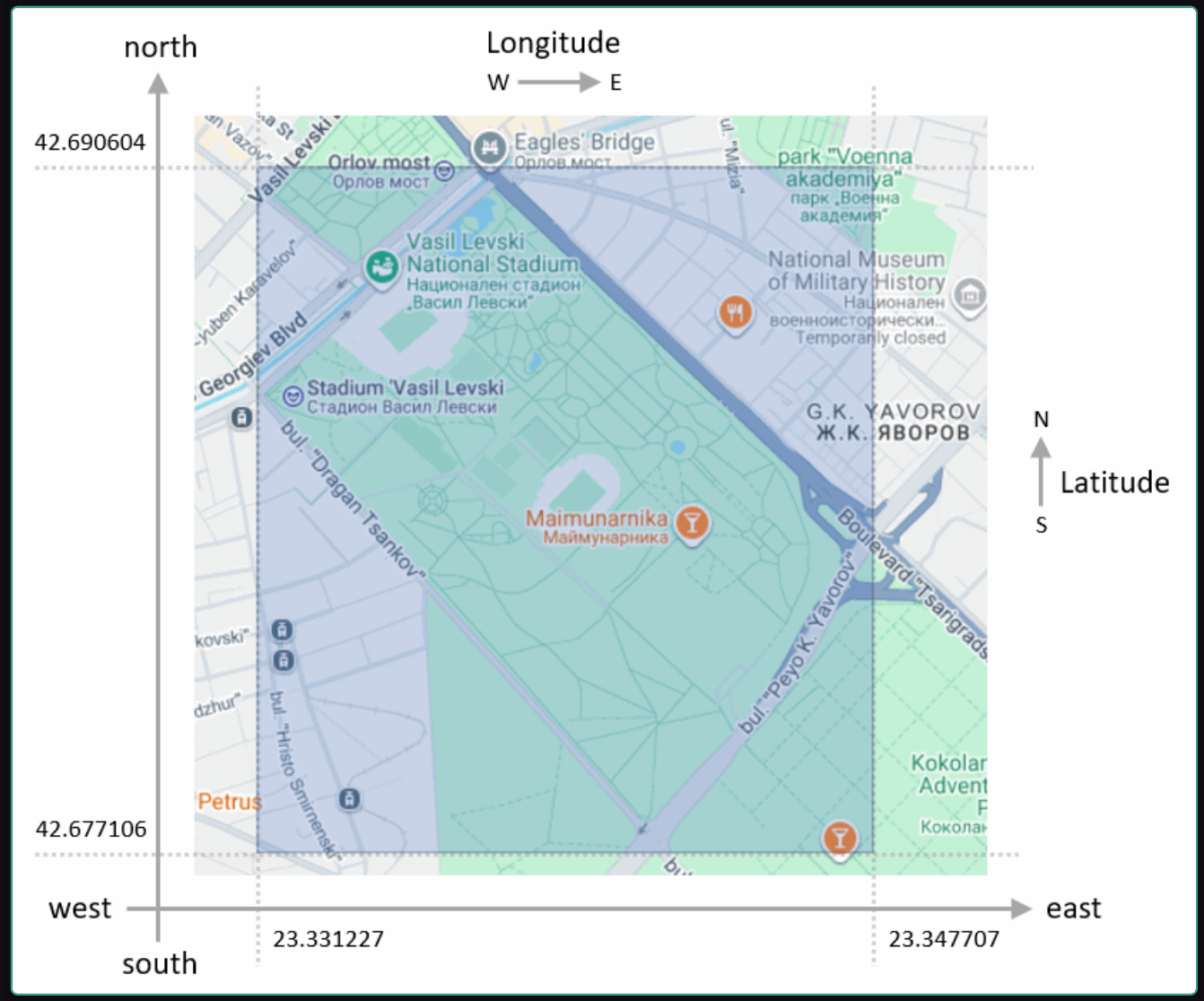
- On the **geographical maps** points have unique **geographic coordinates** (GPS coordinates):
  - **Latitude**: south → north (-90° ... +90°)
  - **Longitude**: west → east (-180° ... +180°)
- Rectangles are defined as:
  - **{SW, NE}** coordinates



Problem: Plots of Land

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- We are given a **GPS location**:
  - JS object: **{location, lat, long}**
  - Example: **{name:"Park Coffee Club", lat:42.686851, long:23.336146}**
- We are also given several **plots of land** (rectangular areas, for simplicity), with their **GPS coordinates**:
  - JS object: **{name, S, W, N, E}**
  - Example: **{name:"Vasil Levski Stadium", S: 42.686344, W: 23.332922, N: 42.689106, E: 23.337278}**
- Write a function to print all **plots that overlap** with the location

Plots of Land – Example

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```
function printCrossingPlots(location, ...plots) { … }
```

```
printCrossingPlots(
 {location:"Park Coffee Club", lat: 42.686851, long: 23.336146},
 {name:"Borisova Gradina Park", S: 42.677265, W: 23.331184, N: 42.690606, E: 23.347621},
 {name:"Vasil Levski Stadium", S: 42.686344, W: 23.332922, N: 42.689106, E: 23.337278},
 {name:"Bulgarian Army Stadium", S: 42.683029, W: 23.338244, N: 42.685191, E: 23.341355},
 {name:"Tennis Club Levski", S: 42.686102, W: 23.336007, N: 42.687132, E: 23.337734}
);
```

```
Crossing plots of Park Coffee Club:
 - Borisova Gradina Park
 - Vasil Levski Stadium
 - Tennis Club Levski
```

Solution: Plots of Land

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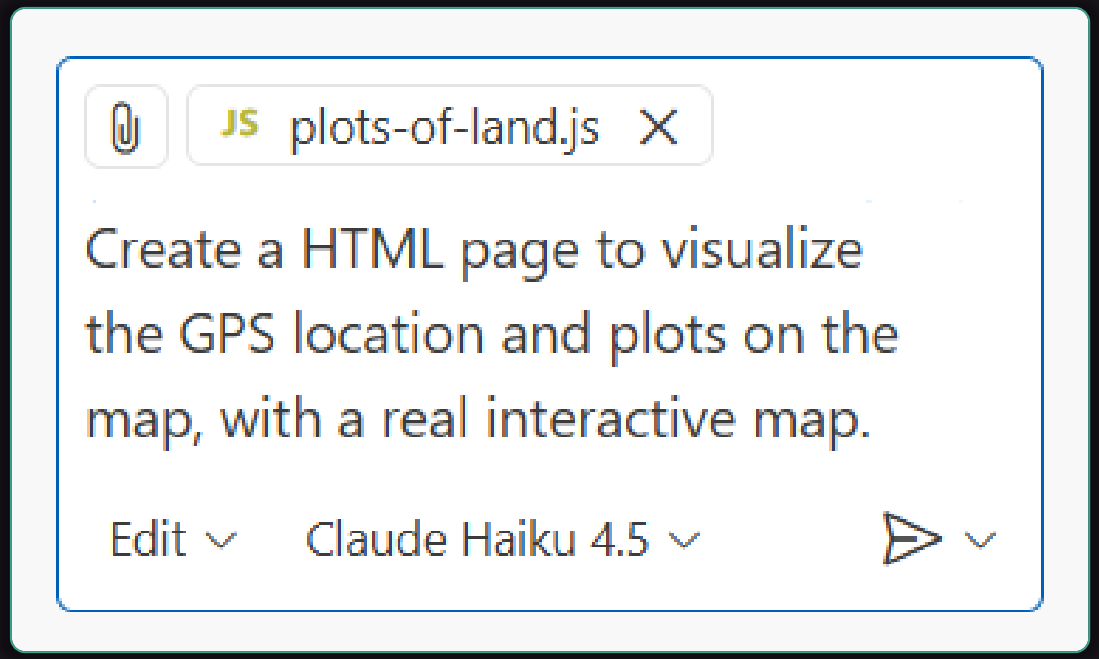
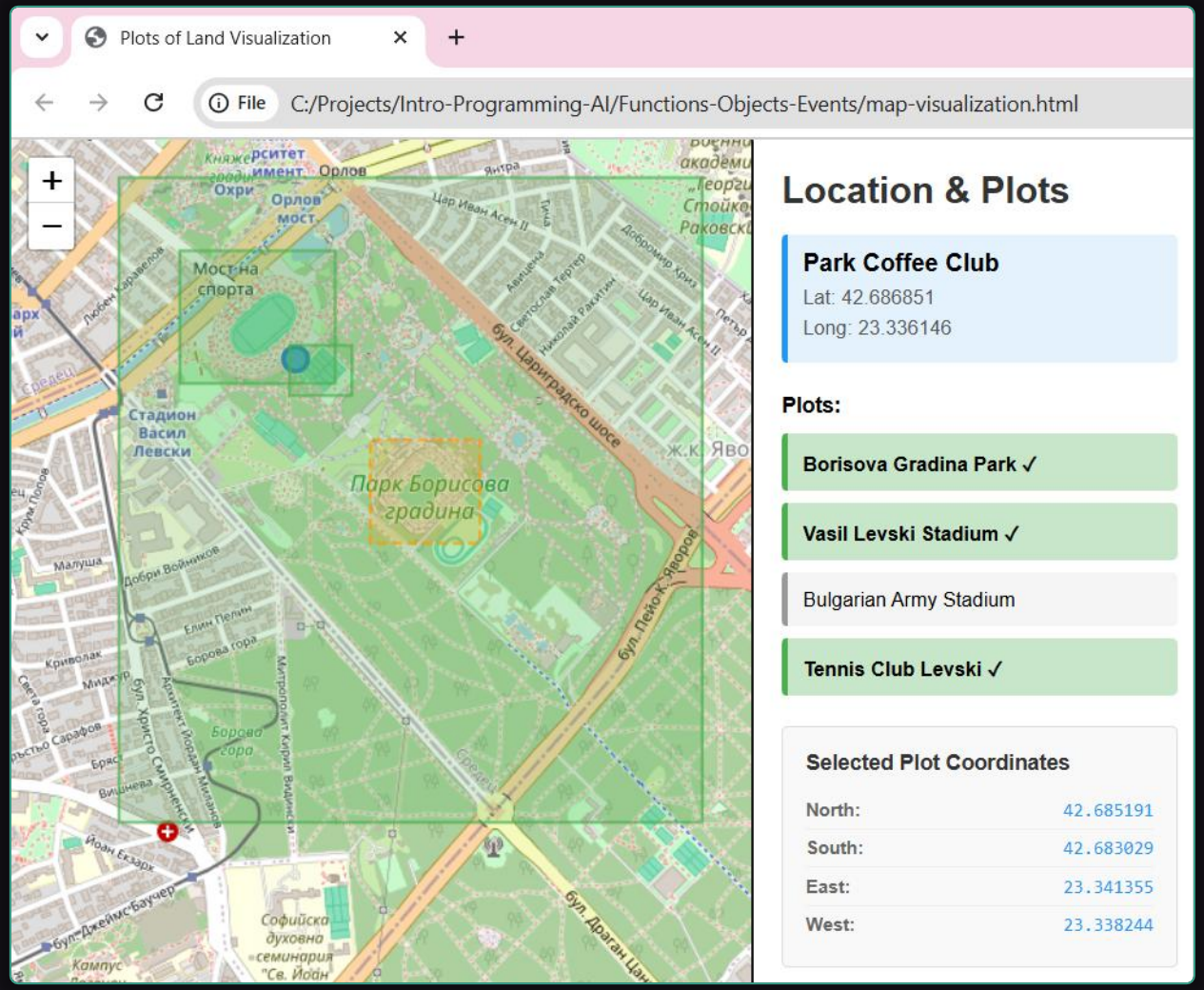
```
function printCrossingPlots({location, lat, long}, ...plots) {
  console.log("Crossing plots of " + location + ":");
  for (let plot of plots) {
    if (lat >= plot.S && lat <= plot.N &&
        long >= plot.W && long <= plot.E) {
      console.log(` - ${plot.name}`);
    }
  }
}
```

Judge link: https://alpha.judge.softuni.org/contests/functions-objects-events/5273

Plot of Land – Visualization

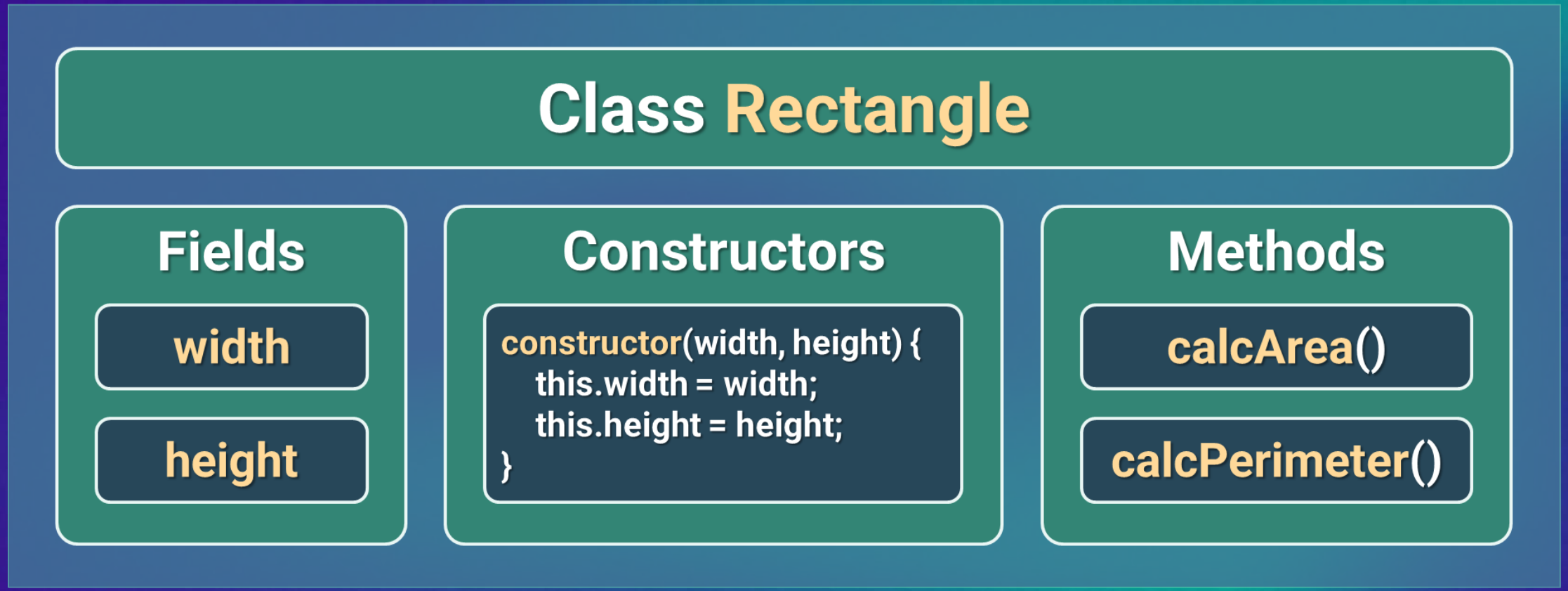
- **Visualize as HTML page**:
  - View the location and plots on an interactive map





Intro to Classes

Classes, Properties, Constructors, Methods



Class Structure

- **Classes** define blueprints for **objects** of the same type
  - Classes hold **properties** (data fields – key-value pairs), **constructors** (field initializers) and **methods** (actions)

Class Rectangle

Properties

- width
- height

Constructors

```
constructor(width, height) {
    this.width = width;
    this.height = height;
}
```

Methods

- calcArea()
- calcPerimeter()

Classes – Example

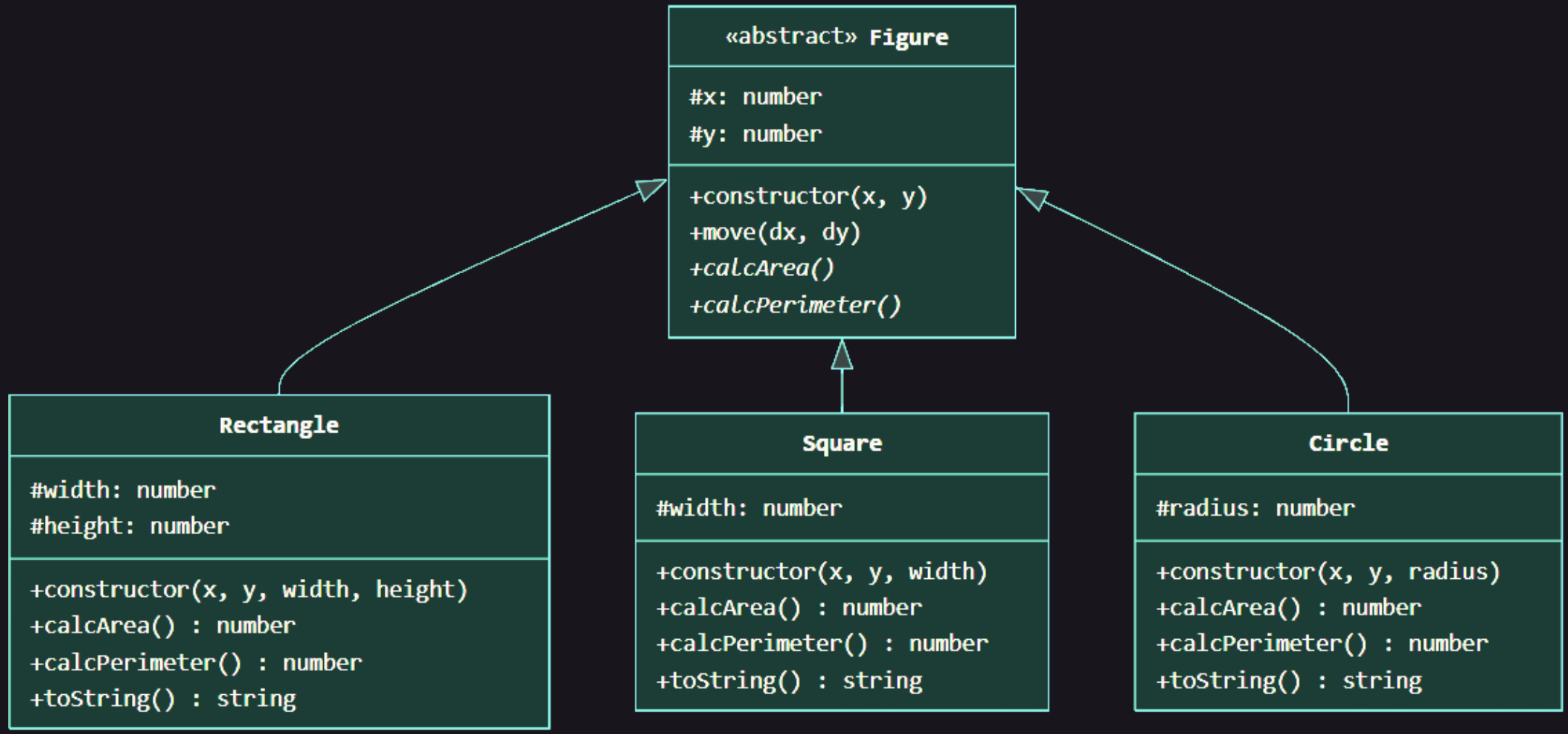
class Rectangle	
state	width, height
constructor	width, height
methods	calcArea() calcPerimeter()

```
class Rectangle {
  constructor(width = 0, height = 0) {
    this.width = width;
    this.height = height;
  }
  calcArea() { return this.width * this.height; }
  calcPerimeter() { return 2 * (this.width + this.height); }
}
```

```
let rect1 = new Rectangle(30, 20);
console.log(rect1, rect1.calcArea(), rect1.calcPerimeter());
let rect2 = new Rectangle(40, 15);
console.log(rect2, rect2.calcArea(), rect2.calcPerimeter());
```

Class Hierarchies

- We can build **hierarchies of classes**, by using **inheritance**



Abstract Base Class Figure

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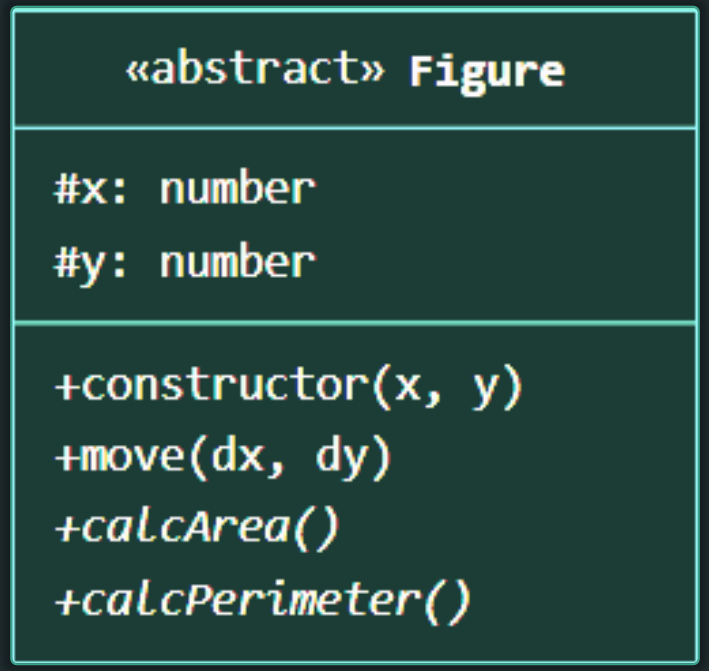
```
class Figure {
  constructor(x = 0, y = 0) {
    this.x = x;
    this.y = y;
  }
  move(dx, dy) {
    this.x += dx;
    this.y += dy;
  }
  calcArea() { throw new Error("Can't call abstract method"); }
  calcPerimeter() { throw new Error("Can't call abstract method"); }
}
```

Shared method:
inherited by subclasses

Abstract methods:
should be implemented in subclasses



Class Rectangle

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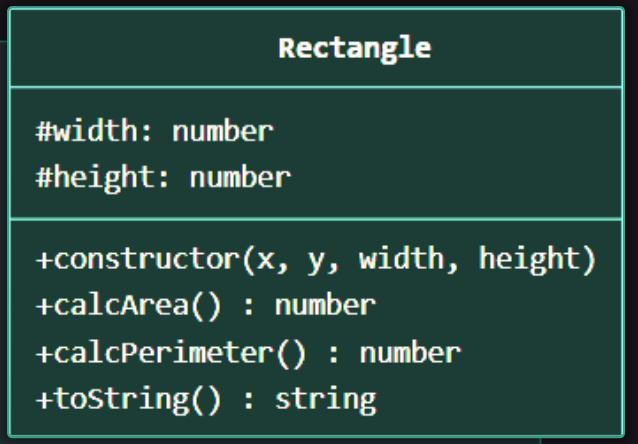
```
class Rectangle extends Figure {
  constructor(x = 0, y = 0, width = 0, height = 0) {
    super(x, y);
    this.width = width;
    this.height = height;
  }
  calcArea() { return this.width * this.height; }
  calcPerimeter() { return 2 * (this.width + this.height); }
  toString() { return `Rectangle(${this.x}, ${this.y}, size
    = ${this.width} x ${this.height})`; }
}
```



Class Square

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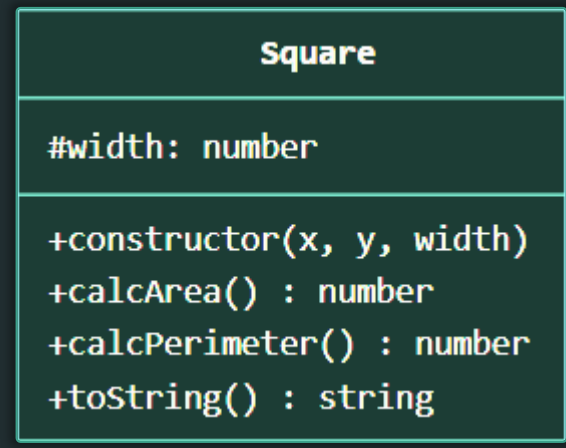
```
class Square extends Figure {
  constructor(x = 0, y = 0, width = 0) {
    super(x, y);
    this.width = width;
  }
  calcArea() { return this.width * this.width; }
  calcPerimeter() { return 4 * this.width; }
  toString() { return `Square(${this.x}, ${this.y},
    width = ${this.width})`; }
}
```



Class Circle

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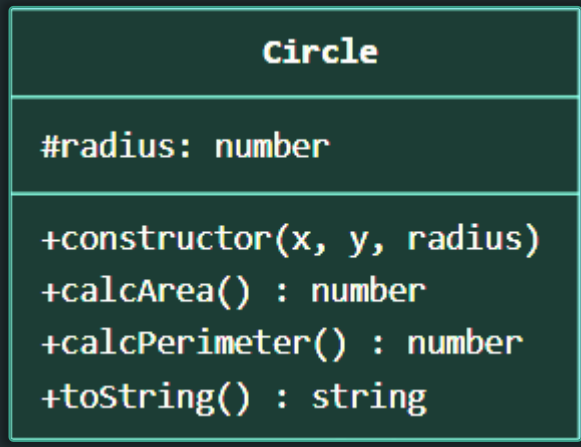
```
class Circle extends Figure {
  constructor(x = 0, y = 0, radius = 0) {
    super(x, y);
    this.radius = radius;
  }
  calcArea() { return Math.PI * this.radius ** 2; }
  calcPerimeter() { return 2 * Math.PI * this.radius; }
  toString() {return `Circle (${this.x}, ${this.y},
    radius = ${this.radius})`; }
}
```



Using the Defined Classes

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```
let r = new Rectangle(10, -5, 10, 5);
r.move(10, -10);
console.log(r);
console.log(r.toString(), r.calcArea(), r.calcPerimeter());

let s = new Square(150, 30, 10);
s.move(-20, 30);
console.log(s.toString(), s.calcArea(), s.calcPerimeter());

let c = new Circle(120, 80, 3);
c.move(0, -5);
console.log(c.toString(), c.calcArea(), c.calcPerimeter());
```

Problem: Largest Figures

- Using the classes **Figure**, **Rectangle**, **Square** and **Circle**, write a JS function
  - Take several **figures** (passed as parameters)
  - Print the figure with the **largest area**
  - Print the figure with the **largest perimeter**

```
printLargestFigures(new Rectangle(10, 15, 300, 120),
  new Square(-20, -50, 200), new Circle(-50, 20, 130));
```

```
Largest area: 53092.92 -> Circle (-50, 20, radius = 130)
Largest perimeter: 840.00 -> Rectangle(10, 15, size = 300 x 120)
```

Solution: Largest Figures

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```
function printLargestFigures(...figures) {
  let largestArea = null, largestPerimeter = null;
  for (let f of figures) {
    if (largestArea == null || f.calcArea() > largestArea.calcArea())
      largestArea = f;
    if (largestPerimeter == null ||
        f.calcPerimeter() > largestPerimeter.calcPerimeter())
      largestPerimeter = f;
  }
  console.log(`Largest area: ${largestArea.calcArea().toFixed(2)}
    -> ${largestArea.toString()}`);
  console.log(`Largest perimeter: ${largestPerimeter.calcPerimeter()
    .toFixed(2)} -> ${largestPerimeter.toString()}`);
}
```

Note: this code cannot be tested in the Judge system

Largest Figures – Visualization

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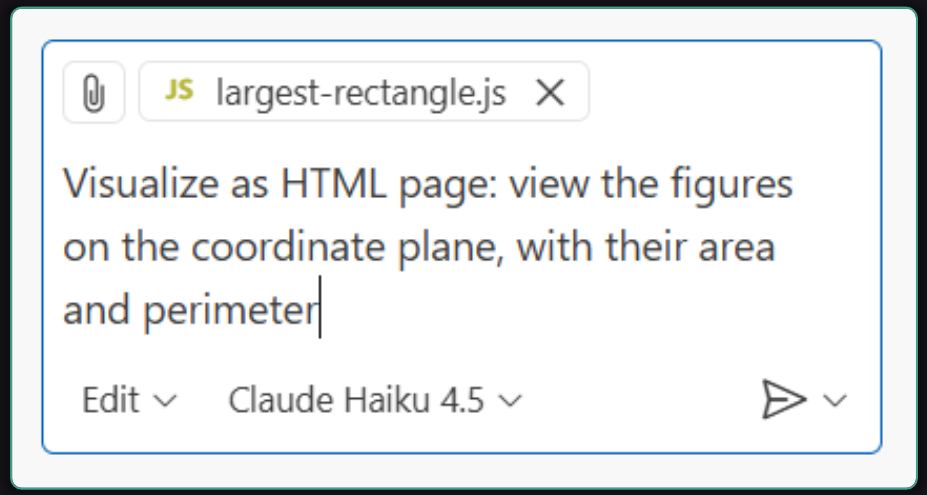
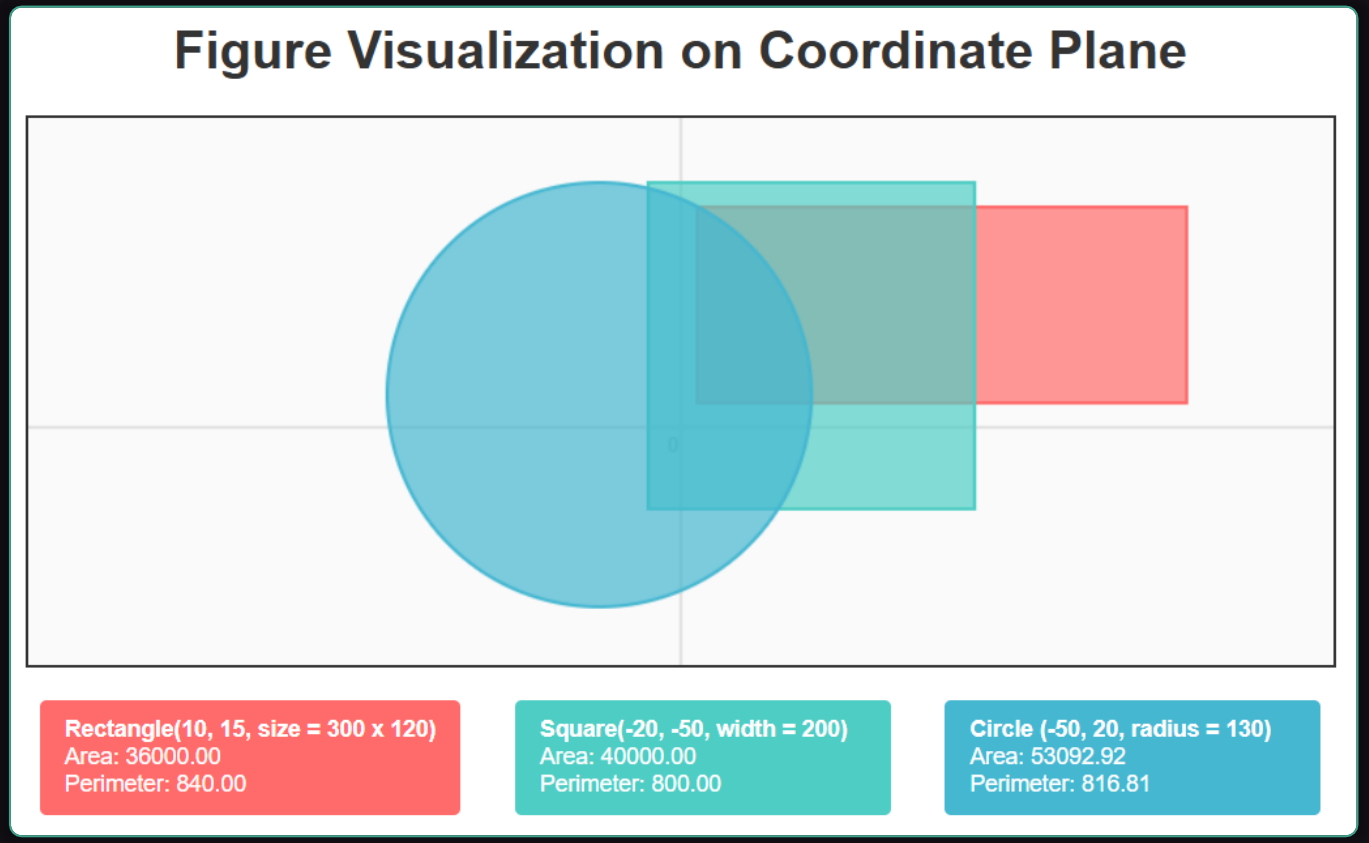
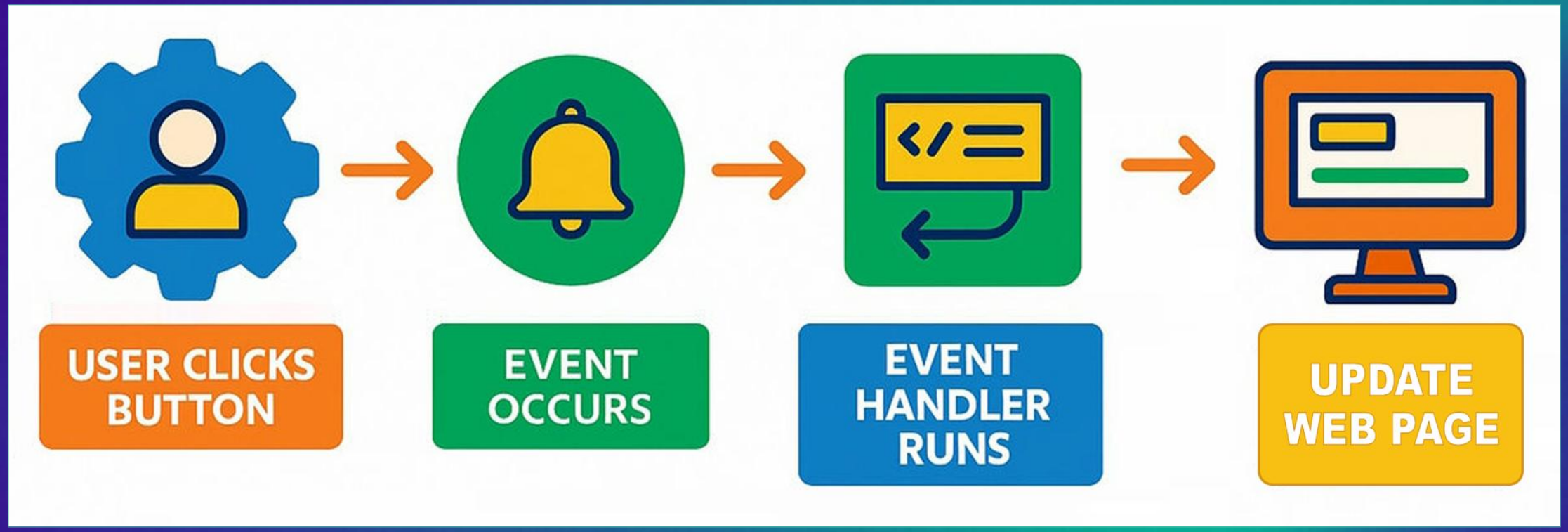
- **Visualize as HTML page**: view the figures on the coordinate plane, with their area and perimeter
- Use a prompt in GitHub Copilot:





Events and Event Handling

Events in HTML and Event Handlers in JS



Events and Event Handlers

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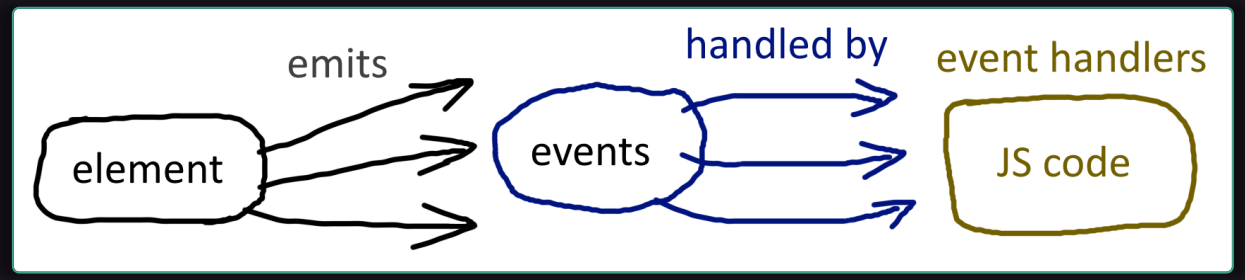
- **HTML** pages hold **elements**: document, form fields, buttons, images, texts, …



- An **event** is some action that happens in the browser, e.g.
  - The **page is loaded**, a **button is clicked**, a form **field is changed**, a **form is submitted**, the **mouse is moved**, etc.
- Elements **emit events** when certain actions happen
- Events are handled by **events handlers** – JS functions (code) that process the occurred event

Event Handling Lifecycle

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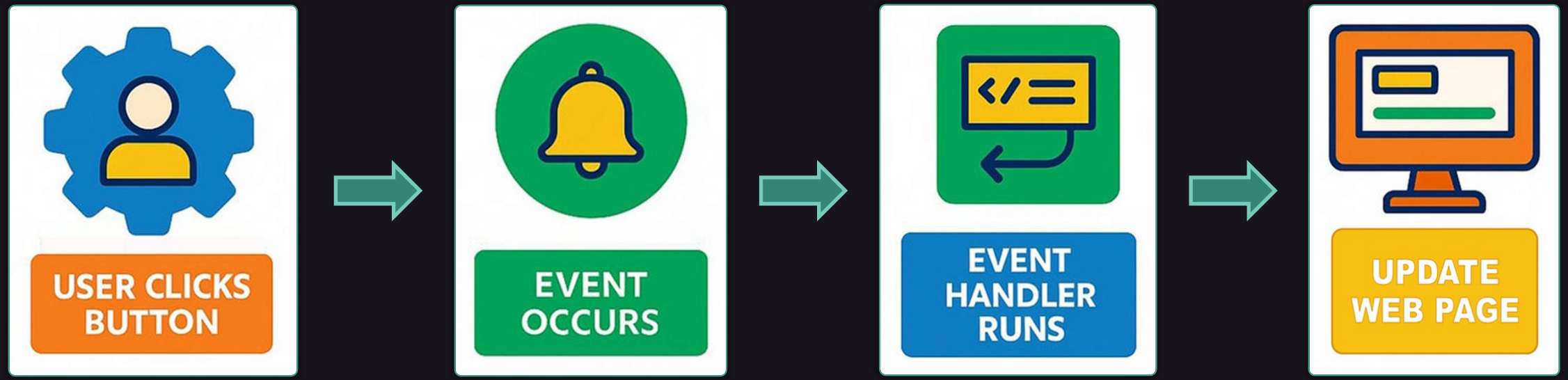
- Event in the Web browser – example:



Event Handling in HTML – Example

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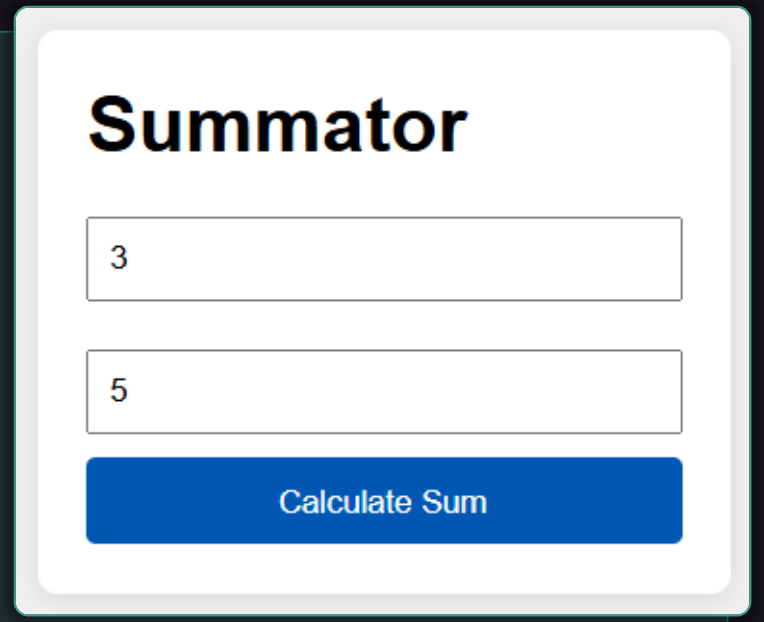
```
<html>
<head><title>Summator</title></head>
<body>
  <h1>Summator</h1>
  <input type="number" id="num1">
  <input type="number" id="num2">
  <button onclick="sum()">Calculate Sum</button>
  <div id="result"></div>
</body>
</html>
```



Event "onclick" handled by JS function "sum()"

Event Handling in HTML – Example

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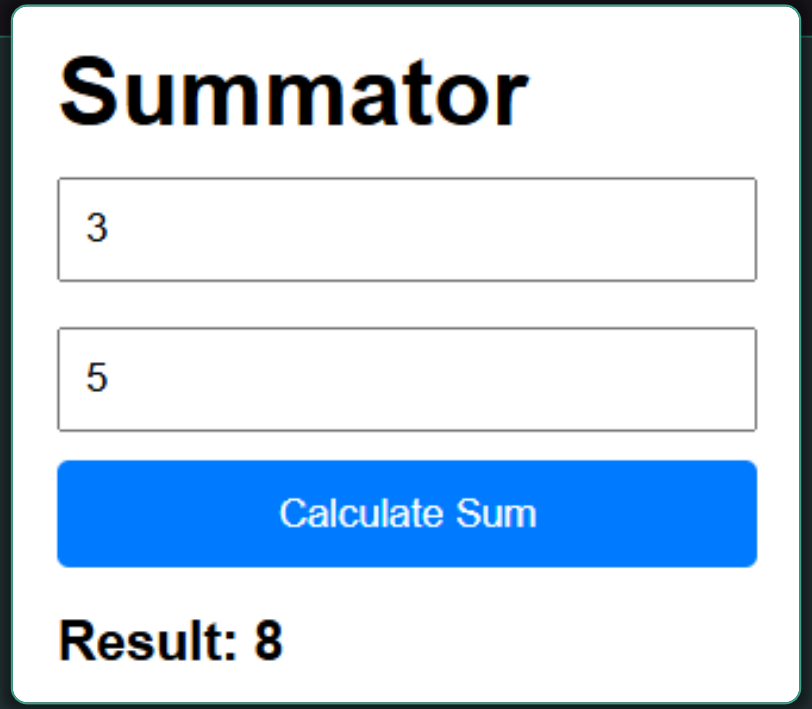
```
<script>
  function sum() {
    let num1 = parseFloat(document.
      getElementById('num1').value);
    let num2 = parseFloat(document.
      getElementById('num2').value);
    let total = num1 + num2;
    document.getElementById('result').
      textContent = `Result: ${total}`;
  }
</script>
```



Debugging HTML + JS

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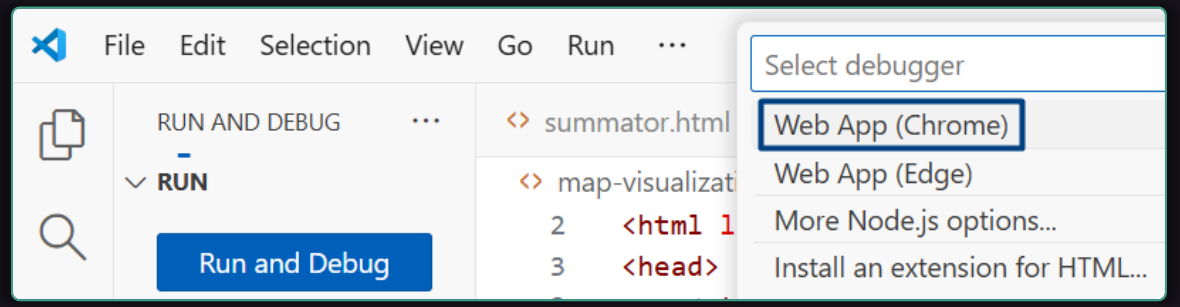
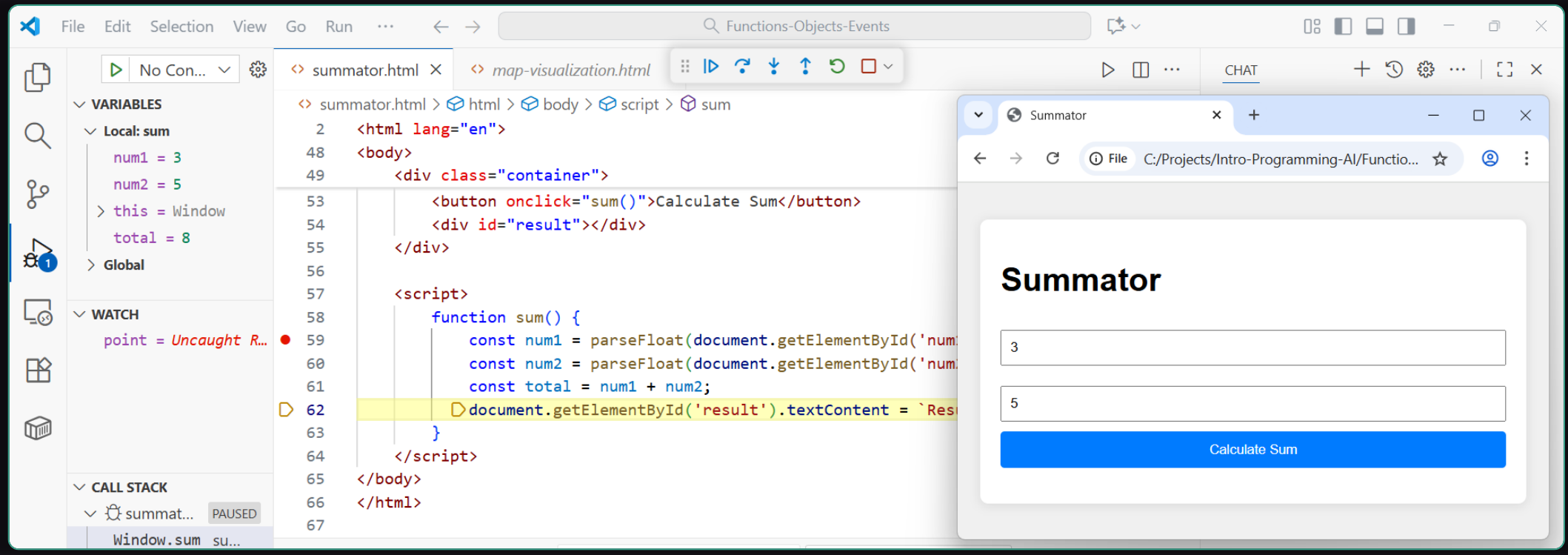
- We can **debug HTML pages** with JavaScript code from the VS Code Debugger:





Lesson Summary

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- **Functions** in JavaScript hold blocks of code, can take parameters, and return result
- **Arrow functions** give short syntax: **(a, b) => a + b**
- **Callback** == function passed to another function
- **Objects** hold key-value pairs: **{ name: "Mia", age: 25 }**
- **Classes** define template for objects: **new Circle(25)**
  - Constructors, properties, methods, this
- **Events** are actions, accruing when something happens, handled by **event handlers**: JS callback functions

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